

HIGH POWER HIGH EFFICIENCY CLADDING PUMPING FIBER LASER

Abstract:

225,616

In the present invention, methods and apparatus for making efficient cladding pumping fiber lasers is disclosed. In particular, new fiber cladding geometry and new method of coupling pumping laser into an optical fiber are disclosed. Both aspects of the present invention will facilitate the realization of high-efficiency and high-power fiber lasers. In the present invention, cladding boundary geometry structures that can prevent the formation of local modes are disclosed. Besides the cladding geometry, methods for efficient coupling of diode lasers into a laser fiber for high power injection are also disclosed. Essentially, the new methods make it possible to transmit diode laser beams for a long distance with substantially the same brightness. In other words, with the methods and apparatus disclosed, a laser beam from a laser diode array with collimating structures can be transmitted for a long distance while the beam spot dimension including beam divergence can be kept substantially unchanged even if the beam from said array is not substantially collimated. With the method taught in the present invention, laser diode array modules can be formed with laser diode arrays (LDA) with collimating structures and relay systems. Because of the brightness conservation nature of the modules, when a plurality of such modules (such as 3, 9, or more than 200 pieces) are combined, the beams from the arrays can be efficiently coupled into an optical fiber. Thus the pumping laser coupling method can be used for the construction of high-efficiency and high-power fiber lasers. Thus, the fiber lasers of this invention may comprise of a fiber laser core doped with active species, a symmetry-broken inner cladding or a multiple-imaging inner cladding surrounding said core, a plurality of brightness substantially-conserved laser diode array module for coupling the beam from said laser diode array module into said inner cladding.